

5 I claim:

1. A communications method comprising:

providing (i) a first signal having a positive entropy and (ii) a plurality of delayed versions of the first signal, each delayed version of the plurality of delayed versions comprising a plurality of available values;

10 encoding data comprising a symbol by representing the symbol as a plurality of delay values, wherein each of said plurality of delay values comprises an available value of the plurality of available values for each delayed version of the plurality of delayed versions; and

transmitting the encoded data across a communications channel.

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2. The communications method according to claim 1, further comprising:

summing the first signal having positive entropy and the plurality of delayed versions of the first signal, the plurality of delayed versions of the first signal comprising the plurality of delay values for the symbol.

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3. The communications method according to claim 1, further comprising:

decoding the encoded data by identifying each transmitted, delayed version of the plurality of delayed versions of the first signal; and

determining a transmitted delay value of the plurality of delay values for each

25 identified delayed version.

5 4. The communications method according to claim 1, wherein the first signal comprises one of a chaotic signal, a noise signal, and a positive entropy, baseband signal modulated onto a positive entropy signal having a higher frequency than the baseband signal.

10 5. The communications method according to claim 1, wherein said decoding step comprises:

generating a second signal substantially similar to the first signal,
summing the second signal and a plurality of reference delays; and
maximizing a cross-correlation between the encoded data and the sum of the
15 second signal and the plurality of reference delays.

6. The communications method according to claim 5, further comprising:
compensating the plurality of reference delays for degradation by the
communications channel of the plurality of delayed versions of the first signal.

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7. The communications method according to claim 1, wherein said decoding step comprises:

generating a weighted third signal substantially similar to the first signal,
summing the weighted third signal and a plurality of weighted reference delays;

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performing a least squares fit between the encoded data and the sum of the third
signal and the plurality of weighted reference delays.

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8. The communications method according to claim 7, further comprising:
compensating the plurality of weighted reference delays for degradation by the
communications channel of the plurality of delayed versions of the first signal.

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9. A communications apparatus comprising:
means for providing (i) a first signal having a positive entropy and (ii) a plurality
of delayed versions of the first signal, each delayed version of the plurality of delayed
versions comprising a plurality of available values;

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means for encoding data comprising a symbol by representing the symbol as a
plurality of delay values, wherein each of said plurality of delay values comprises an
available value of the plurality of available values for each delayed version of the
plurality of delayed versions; and

means for transmitting the encoded data across a communications channel.

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10. The communications apparatus according to claim 9, further comprising:
means for summing the first signal having positive entropy and the plurality of
delayed versions of the first signal, the plurality of delayed versions of the first signal
comprising the plurality of delay values for the symbol.

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11. The communications apparatus according to claim 9, further comprising:
means for decoding the encoded data by identifying each transmitted delayed
version of the plurality of delayed versions of the first signal; and

5 means for determining a transmitted delay value of the plurality of delay values
for each identified, delayed version.

12. The communications apparatus according to claim 9, wherein the first signal
comprises one of a chaotic signal, a noise signal, and a positive entropy, baseband signal
10 modulated onto a positive entropy signal having a higher frequency than the baseband
signal.

13. The communications apparatus according to claim 9, wherein said decoding
means comprises:

15 means for generating a second signal substantially similar to the first signal,
means for summing the second signal and a plurality of reference delays; and
means for maximizing a cross-correlation between the encoded data and the sum
of the second signal and the plurality of reference delays.

20 14. The communications apparatus according to claim 13, further comprising:
means for compensating the plurality of reference delays for degradation by the
communications channel of the plurality of delayed versions of the first signal.

15. The communications apparatus according to claim 9, wherein said decoding
25 means comprises:
means for generating a weighted third signal substantially similar to the first
signal,

5 means for summing the weighted third signal and a plurality of weighted reference delays; and

 means for performing a least squares fit between the encoded data and the sum of the third signal and the plurality of weighted reference delays.

10 16. The communications apparatus according to claim 15, further comprising:
 means for compensating the plurality of weighted reference delays for degradation by the communications channel of the plurality of delayed versions of the first signal.

15 17. A communications device comprising:
 a symbol encoder for receiving data comprising a symbol and for receiving a first signal having a positive entropy, the symbol encoder adding to the first signal a plurality of delayed versions of the first signal, each delayed version of the plurality of delayed versions comprising a plurality of available values, the symbol being represented by a set
20 of delay values, a delay value of the set of delay values comprising an available value of the plurality of available values for the each delayed version of the plurality of delayed versions; and

 a transmitter for receiving the encoded data from the symbol encoder and for transmitting the encoded data.

25 18. The communications device according to claim 17, wherein the first signal having positive entropy comprises one of a chaotic signal, noise signal, and a positive

5 entropy, baseband signal modulated onto a positive entropy signal having a higher
frequency than the baseband signal.

19. The communications device according to claim 18, wherein the chaotic signal
comprises one of a Lorenz system-generated chaotic signal and a Rossler system-
10 generated chaotic signal.

20. A communications device for receiving encoded data, the communications
device comprising:

a receiver for receiving a first signal having positive entropy added to a plurality
15 of delayed versions of the first signal, each delayed version of the plurality of delayed
versions comprising a plurality of available values, wherein encoded data comprises a
symbol, the symbol being represented by a plurality of delay values, a delay value of the
plurality of delay values comprising an available value of the plurality of available values
for the each delayed version of the plurality of delayed versions; and

20 a symbol decoder for receiving the encoded data from said receiver, the symbol
decoder

for summing a second signal, substantially similar to the first signal, and a
plurality of reference delays, and

for maximizing a cross-correlation between the encoded data and the sum
25 of the second signal and the plurality of reference delays.

5 21. The communications device according to claim 20, wherein the first signal having positive entropy comprises one of a chaotic signal, noise signal, and a positive entropy, baseband signal modulated onto a positive entropy signal having a higher frequency than the baseband signal.

10 22. The communications device according to claim 21, wherein the chaotic signal comprises one of a Lorenz system-generated chaotic signal and a Rossler system-generated chaotic signal.

 23. The communications device according to claim 20, further comprising an
15 equalizer communicating with said receiver and with said symbol decoder.

 24. A communications device for receiving encoded data, the communications device comprising:

 a receiver for receiving a first signal having positive entropy added to a plurality
20 of delayed versions of the first signal, each delayed version of the plurality of delayed versions comprising a plurality of available values, wherein encoded data comprises a symbol, the symbol being represented by a plurality of delay values, a delay value of the plurality of delay values comprising an available value of the plurality of available values for the each delayed version of the plurality of delayed versions; and

25 a symbol decoder for receiving the encoded data from said receiver, the symbol decoder

5 for summing a third signal, being a weighted version of the first signal,
and a plurality of weighted reference delays, and
for performing a least squares fit between the encoded data and the sum of
the third signal and the plurality of weighted reference delays.

10 25. The communications device according to claim 23, wherein the first signal
having positive entropy comprises one of a chaotic signal, noise signal, and a positive
entropy, baseband signal modulated onto a positive entropy signal having a higher
frequency than the baseband signal.

15 26. The communications device according to claim 25, wherein the chaotic signal
comprises one of a Lorenz system-generated chaotic signal and a Rossler system-
generated chaotic signal.

20 27. The communications device according to claim 24, further comprising an
equalizer communicating with said receiver and with said symbol decoder.